CLAIMS

WHAT IS CLAIMED IS:

1. A superconducting magnet comprising a plurality of superconducting coils, said coils being impregnated with epoxy and nested within each other, an innermost one of the nested coils having a bore therethrough defining a bore width of the magnet, said bore width being greater than approximately 100 millimeters, said nested coils being electrically connected in series and cooled to an operating temperature less than approximately 4 degrees K.

2. The magnet of claim 1 wherein at least one of the superconducting coils includes a wind and react conductor, said wind and react conductor being heat treated prior to impregnating the at least one of the superconducting coils with epoxy.

3. The magnet of claim 2 further comprising an external reinforcement on the wind and react conductor, said external reinforcement being applied prior to heat treating the wind and react conductor.

4. The magnet of claim 1 further comprising an external reinforcement on at least one of the superconducting coils, said external reinforcement being applied prior to impregnating the at least one of the superconducting coils to be reinforced with epoxy.

5. The magnet of claim 4 wherein the external reinforcement includes a reinforcement wire wound around the at least one of the superconducting coils to be reinforced.

6. The magnet of claim 5 wherein the reinforcement wire is electrically insulated with a high temperature insulation.

7. The magnet of claim 6 wherein the high temperature insulation is a glass fiber braid.

8. The magnet of claim 5 wherein the reinforcement wire is electrically insulated to prevent electrical short circuits of the reinforcement wire to itself.

9. The magnet of claim 5 wherein the reinforcement wire is steel.

10. The magnet of claim 5 wherein the reinforcement wire includes steel and copper.

11. The magnet of claim 4 wherein the external reinforcement has a pair of leads extending therefrom connected through a diode.

12. The magnet of claim 1 further comprising an active protection circuit for protecting one or more of the coils in response to a quench in the magnet, said protection circuit including at least one heater element for heating the protected coil.

13. The magnet of claim 12 wherein the heater element comprises a substantially flat metallic braid.

14. The magnet of claim 13 wherein the braid comprises a resistive metal.

15. The magnet of claim 13 wherein the braid is approximately 0.1 mm or less.

16. The magnet of claim 13 wherein the braid is generally U-shaped.

17. The magnet of claim 12 wherein the heater element is positioned in thermal contact with the protected coil prior to impregnating the coil with epoxy.

18. The magnet of claim 12 wherein at least one of the superconducting coils includes a wind and react conductor, said wind and react conductor being heat treated prior to impregnating the at least one of the superconducting coils with epoxy, and wherein the heater element is

positioned in thermal contact with the protected coil prior to heat treating the wind and react conductor.

19. The magnet of claim 1 wherein the superconducting coils have lead wires extending therefrom and further comprising a lead support for supporting each of the lead wires with epoxy adjacent an end of the respective coil.

20. The magnet of claim 19 wherein the lead support is generally frustoconical in shape and integrally formed with the epoxy impregnating the respective coil using a mold placed around the lead wire adjacent the end of the respective coil prior to impregnating the coils with epoxy.

21. The magnet of claim 20 wherein the lead support is an epoxy composite material.

22. The magnet of claim 19 wherein the lead support includes a stabilizing member securing a portion of at least one of the lead wires.

23. A superconducting magnet comprising a plurality of superconducting coils, said coils being impregnated with epoxy and nested within each other, said nested coils being electrically connected in series and cooled to an operating temperature less than approximately 4 degrees K; and

an external reinforcement on at least one of the coils, said external reinforcement being applied prior to impregnating the coil to be reinforced with epoxy.

24. A superconducting magnet comprising:

a plurality of superconducting coils, said coils being impregnated with epoxy and nested within each other, said nested coils being electrically connected in series and cooled to an operating temperature less than approximately 4 degrees K; and

an active protection circuit for protecting one or more of the coils in response to a quench in the magnet, said protection circuit including at least one heater element for heating

the protected coil, said heater element being positioned in thermal contact with the protected coil prior to impregnating the coil with epoxy.

25. A superconducting magnet comprising:

a plurality of superconducting coils, said coils being impregnated with epoxy and nested within each other, said nested coils being electrically connected in series and cooled to an operating temperature less than approximately 4 degrees K, said coils further having lead wires extending therefrom; and

a lead support for supporting each of the lead wires with epoxy adjacent an end of the respective coil.